

Technology Brief — Getac Night Vision Technology

Making Every Nighttime Mission a Success with Getac's Night Vision Technology

Night vision technology includes two parts:

NVG (Night Vision Goggles) and *NVIS (Night Vision Imaging Systems)*.

A. Night Vision Goggles (NVG)

Night vision goggles enhance images through use of a micro-channel plate (MCP) designed to enable the observation of optical electronic images by intensifying weak optical signals. NVGs have been widely used in military applications and have now evolved to their third generation.



[Figure 1] MIL-STD-3009
Compliant MSM
Used in B-52

B. Night Vision Imaging Systems (NVIS)

Military-Spec. Monitors (MSM) require compatibility with Night Vision Imaging Systems to enable NVG wearers to complete nighttime missions, and must be MIL-STD-3009 (or MIL-L-85762A) compliant. Figure 1 indicates a MIL-STD-3009 compliant MSM used in the Boeing B52 bomber, a well-known application example of Boeing's Evolutionary Data Link (EDL) system that incorporates three NVIS monitors in its cockpit.

A Mobile Computing System that supports night vision allows end users to be able to operate the system while wearing night vision goggles, and is also classified as an NVIS system that should meet the following three requirements listed in MIL-STD-3009 Gen. III Class B specifications (Figure 2).

Two commonly used MSM technologies for nighttime missions are:

NVIS filters attached externally to MSM by either "overhanging" or "sticking" methods:

"Overhanging" is a technique normally used with rugged notebooks or PDAs, while "sticking" is traditionally used in fixed MSMs. However, there are inherent disadvantages to using external NVIS filter modules. NVG users must carry NVIS filters with them, which can result in potential damage to or loss of the filters. Using an external NVIS filter will also cause temporary unavailability of touch screen functions.

Co-existence of standard and night vision-compatible backlight sources for the Liquid Crystal Module within an MSM:

CCFL tubes and LED light bars are built into the MSM and used simultaneously as backlight sources with a specially designed IR cut-off filter in the light path. Users can toggle the Liquid Crystal Module (LCM) back

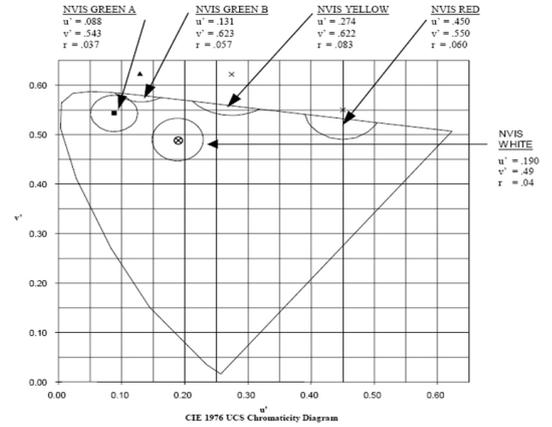
light source between standard and NVIS mode depending on whether they are wearing NVGs or not. This technology is currently used in fixed type MSMs due to the large space required.

1. Brightness ≤ 1.71 nits (cd/m²)
2. NVIS Radiance $\leq 2.2 \times 10^{-9}$ (or Maximum 11×10^{-9})
3. Chromaticity (u', v') = (0.19, 0.49), $\Delta u'v' \leq 0.04$

| Lighting components | Paragraph | TYPE I | | | | TYPE II | | | | |
|---|----------------|------------------------------------|---------------------------------------|-------------------|------------------------------------|---------------------------------------|-------------------|------------------------------------|---------------------------------------|--------------------|
| | | Class A | | Class B | | Class A | | Class B | | |
| | | Not Less Than: (nNR _A) | Not Greater Than: (nNR _B) | cd/m ² | Not Less Than: (nNR _A) | Not Greater Than: (nNR _B) | cd/m ² | Not Less Than: (nNR _A) | Not Greater Than: (nNR _B) | cd/m ² |
| Primary | 4.3.5.1 | --- | 0.17 | 0.343 | --- | 0.17 | 0.343 | --- | 0.17 | 0.343 |
| Secondary | 4.3.5.2 | --- | 0.17 | 0.343 | --- | 0.17 | 0.343 | --- | 0.17 | 0.343 |
| Illuminated controls | 4.3.5.3 | --- | 0.17 | 0.343 | // Same as Class A | | --- | 0.17 | 0.343 | // Same as Class A |
| Compartment | 4.3.5.4 | --- | 0.17 | 0.343 | // Same as Class A | | --- | 0.17 | 0.343 | // Same as Class A |
| Utility, map, work, and navigation lights | Green White | 4.3.5.5 | --- | 1.0 | 0.343 | --- | 0.17 | 0.343 | --- | 1.0 |
| Caution and advisory lights | 4.3.5.6 | --- | 0.17 | 0.343 | --- | 0.17 | 0.343 | --- | 0.17 | 0.343 |
| Jump lights | 4.3.5.7 | 17.1 | 50 | 17.1 | 16 | 47 | 17.1 | --- | 50 | 17.1 |
| Warning signal | 4.3.5.8 | 50 | 150 | 51.5 | 47 | 140 | 51.5 | --- | 150 | 51.5 |
| Master caution signal | 4.3.5.9 | 50 | 150 | 51.5 | 47 | 140 | 51.5 | --- | 150 | 51.5 |
| Emergency exit lighting | --- | 50 | 150 | 51.5 | 47 | 140 | 51.5 | --- | 150 | 51.5 |
| Electronic and electro-optical displays (monochromatic) | White | --- | 0.17 | 1.71 | --- | 0.16 | 1.71 | --- | 0.17 | 1.71 |
| Electronic and electro-optical displays (multi-color) | MAX | --- | 12 | 1.71 | --- | 11 | 1.71 | --- | 12 | 1.71 |
| HUD systems | 4.3.5.10 | 1.71 | 5.1 | 17.1 | 1.6 | 4.7 | 17.1 | --- | 1.7 | 17.1 |

Where:

nNR_A = nano NVIS radiance requirements for Class A equipment.
nNR_B = nano NVIS radiance requirements for Class B equipment.
"---" = abbreviated "n", represents a factor of 10⁻⁹, which is factored out of the radiance numbers in this table.
cd/m² = Candela per square meter, sometimes called "nits".

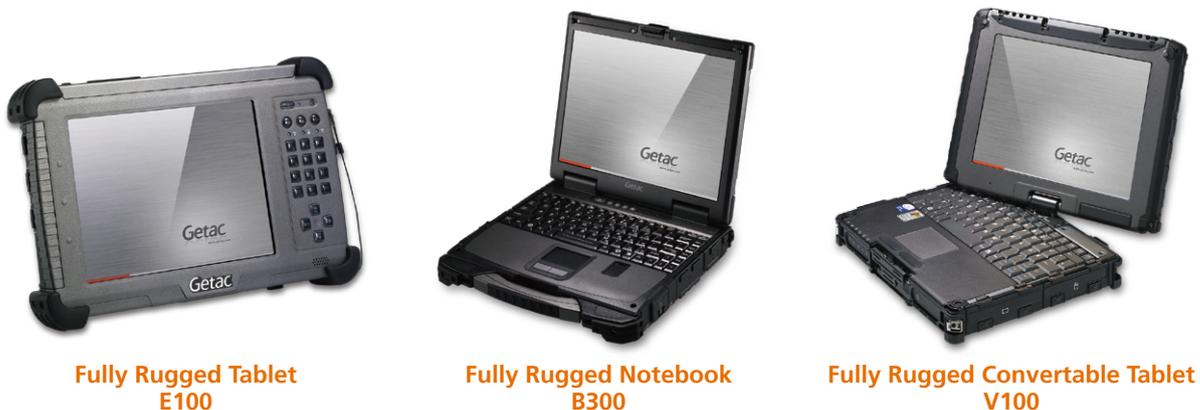


[Figure 2] MIL-STD-3009 Specifications

Getac MIL-STD-3009 Compliant Night Vision Display Technology

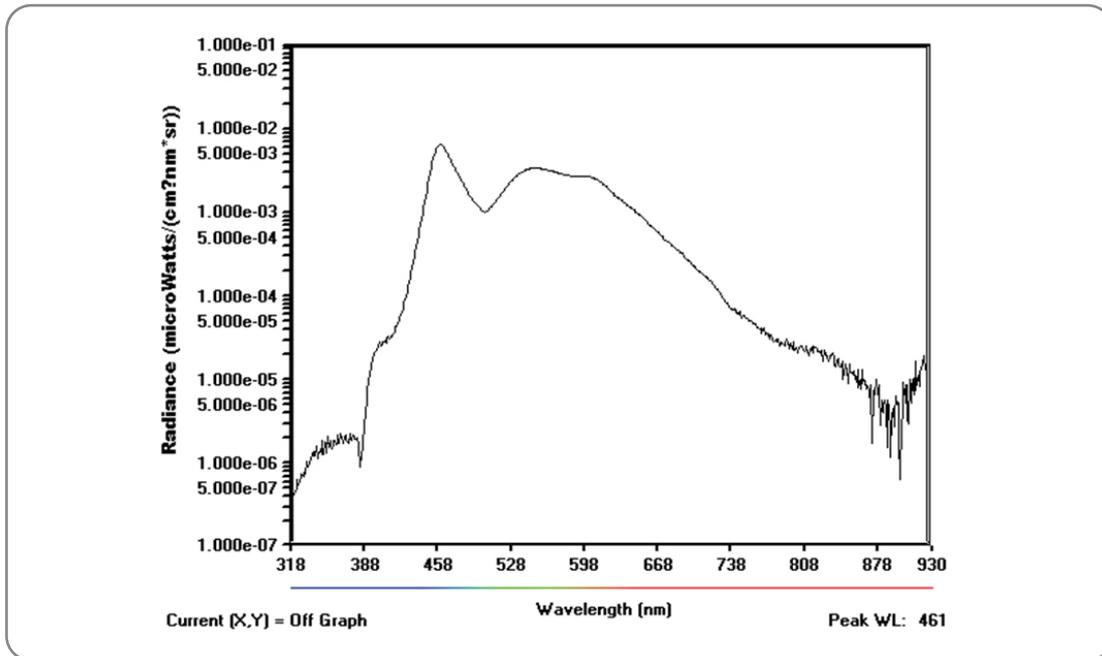
Getac's MIL-STD-3009 compliant night vision displays are designed for all-day operation. They not only achieve great daytime readability under strong sunlight conditions (B300: 1200nits / ECR: 41.7@10K lux; E100: 800nits / ECR: 24@10K lux; V100:1200nits / ECR: 34.6@10K lux), but also function in night vision operation mode without the use of an external NVIS filter. Simply clicking on a preset function key or software shortcut icon will switch the display from standard operation mode to night vision mode. MIL-STD-3009 compliant Getac products with sunlight-readable display technology are shown below in Figure 3.

These products are equipped with Getac's patented Spectrum Adjustment Technology (SAT), which is built into the display's proprietary LED backlight module. Once the night vision mode is triggered, both red and infrared light will be properly adjusted to prevent images from appearing over-saturated dueing 650nm output by the MCP in third-generation night vision goggles. Figures 4.1 and 4.2 illustrate the difference between the spectrum of a standard light source and the spectrum of night vision light source.

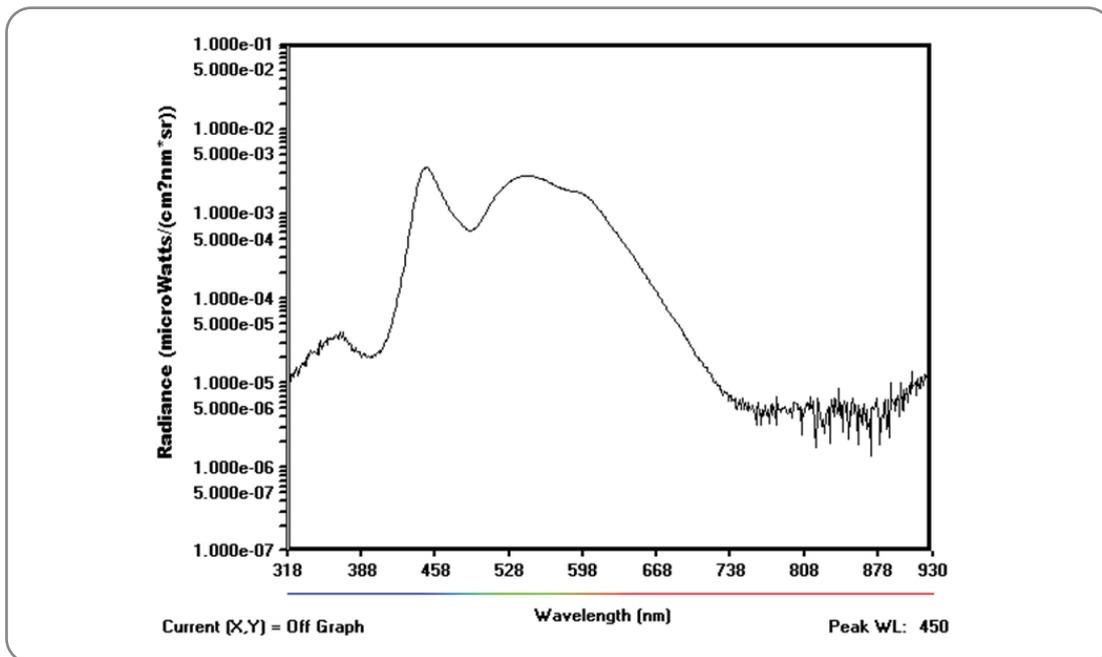


[Figure 3] Sunlight Readable Mil-STD-3009 Compliant Notebooks & Tablet PC

The night vision mode of Getac products can be customized with several different brightness levels SAT technology enhances the display functionality of portable devices with no added weight penalty. The use of LED backlights is also more eco-friendly and provides extra product ruggedness.



[Figure 4-1] Spectrum of Std. Light Source



[Figure 4-2] Spectrum of NV Light Source

Value to Customers

- **Integrated Night Vision Support:**

Getac's night vision technology is built into the product and requires no external NVIS filters for operation. Night vision mode is switched on easily with one easy mouse click or a quick button press.

- **Dust and Water Resistant:**

Getac's night vision compatible LCD displays feature water-resistant technology that allows reliable operation in challenging environments.

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